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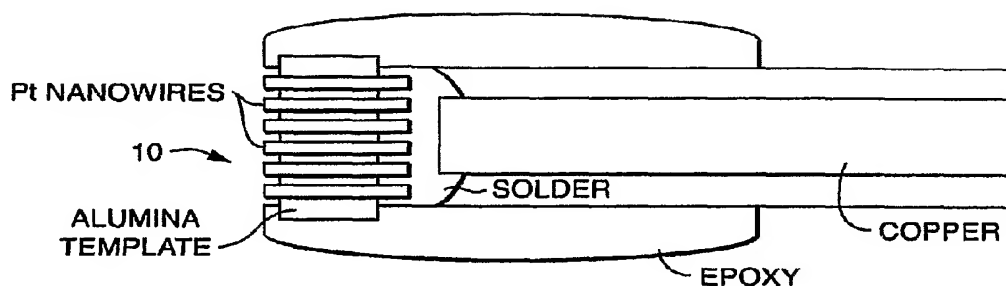
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(88) Date of publication of the international search report:

8 November 2007

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MICROELECTRODE SYSTEMS FOR NEURO-STIMULATION AND NEURO-SENSING AND MICROCHIP PACKAGING AND RELATED METHODS



(57) Abstract: Microelectrode assemblies and related methods are disclosed for bio-stimulating and/or bio-sensing a target tissue. The assemblies can include a two-side substrate, an array of microelectrodes, each of the microelectrodes including a nano-wire embedded within the substrate and extending from a proximal end to a distal end and through the substrate, each nano-wire having a diameter preferably less than 1  $\mu\text{m}$ . The substrate can include portions made of nano-porous material(s) through which the microelectrodes pass. The substrate with the embedded nano-wires can effectively be fluid impermeable. The proximal ends of the nano-wires can be adapted to be connected to an electronic device and the distal ends are adapted to be disposed in a biological environment for bio-stimulating a target tissue and/or bio-sensing activities of the target tissue. Suitable alloys such as platinum, platinum-iridium, and/or other noble-metal-alloyed compositions can be used for the nano-wires.



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# INTERNATIONAL SEARCH REPORT

International application No  
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A. CLASSIFICATION OF SUBJECT MATTER  
INV. A61N1/05 A61B5/04 C25D3/50

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61N A61B H01L C25D H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>SCRIBNER D ET AL: "Intraocular retinal prosthesis test device" PROCEEDINGS OF THE 23RD. ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY. 2001 CONFERENCE PROCEEDINGS. (EMBS). INSTANBUL, TURKEY, OCT. 25 - 28, 2001, ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN M, vol. VOL. 1 OF 4. CONF. 23, 25 October 2001 (2001-10-25), pages 3430-3435, XP010593845 ISBN: 0-7803-7211-5 the whole document</p> <p style="text-align: center;">----- -/--</p>	<p>1-12,20, 21,23</p>

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

24 August 2007

Date of mailing of the international search report

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Name and mailing address of the ISA/

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# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2006/038061

**C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 00/09008 A1 (UNIV EMORY [US]) 24 February 2000 (2000-02-24) figures 4A-4c,5 page 4, line 19 - page 7, line 11 page 13, line 1 - page 15, line 31	1-24,57
Y	WO 03/046265 A2 (MASSACHUSETTS INST TECHNOLOGY [US]) 5 June 2003 (2003-06-05) figures 1,2,4,10 page 1, line 12 - page 3, line 22 page 5, line 17 - page 11, line 27	3,4,7,8, 13-24,57
Y	WO 01/70873 A2 (UNIV MASSACHUSETTS [US]; TUOMINEN MARK [US]; SCHOTTER JOERG [US]; THUR) 27 September 2001 (2001-09-27) figures 1,2 page 2, line 4 - page 4, line 18	5
Y	WO 2004/097894 A2 (UNIV PITTSBURGH [US]; KIM HONG KOO [US]; SUN ZHIJUN [US]) 11 November 2004 (2004-11-11) paragraph [0035] - paragraph [0068] paragraph [0080] - paragraph [0091]	14
X	BAUER L. A., BIRENBAUM N. S., MEYER G. J.: "Biological applications of high aspect ratio nanoparticles" J. MATER. CHEM., vol. 14, 14 January 2004 (2004-01-14), pages 517-526, XP002448019 Scheme 1 figure 1 page 517, left-hand column, paragraph 1 - page 519, right-hand column, paragraph 2	37-44
X	US 2002/158342 A1 (TOUMINEN MARK [US] ET AL TUOMINEN MARK [US] ET AL) 31 October 2002 (2002-10-31) figures 1,2,14 paragraph [0007] - paragraph [0009] paragraph [0051] - paragraph [0057] paragraph [0074] - paragraph [0075] paragraph [0081] - paragraph [0100] paragraph [0125] - paragraph [0138]	37,42, 45-55
X	RABIN O ET AL: "FORMATION OF THICK POROUS ANODIC ALUMINA FILMS AND NANOWIRE ARRAYS ON SILICON WAFERS AND GLASS" August 2003 (2003-08), ADVANCED FUNCTIONAL MATERIALS, WILEY VCH, WIENHEIM, DE, PAGE(S) 631-638 , XP001169879 ISSN: 1616-301X the whole document	45-55

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## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/038061

## C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>HUMAYUN M S ET AL: "Towards a completely implantable, light-sensitive intraocular retinal prosthesis"</p> <p>PROCEEDINGS OF THE 23RD. ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN MEDICINE AND BIOLOGY SOCIETY. 2001 CONFERENCE PROCEEDINGS. (EMBS). INSTANBUL, TURKEY, OCT. 25 - 28, 2001, ANNUAL INTERNATIONAL CONFERENCE OF THE IEEE ENGINEERING IN M, vol. VOL. 1 OF 4. CONF. 23, 25 October 2001 (2001-10-25), pages 3422-3425, XP010593843</p> <p>ISBN: 0-7803-7211-5</p> <p>page 3422, left-hand column, paragraph 1 - right-hand column, paragraph 2</p> <p>page 3423, left-hand column, paragraph 2 - right-hand column, paragraph 3</p> <p>page 3424, right-hand column, paragraph 1</p> <p>-----</p>	25-36,56
A	<p>US 3 207 680 A (MACNAMARA ELIZABETH L)</p> <p>21 September 1965 (1965-09-21)</p> <p>column 2, line 5 - line 44</p> <p>-----</p>	25-36,56
A	<p>BAUMGÄRTNER M. E., RAUB CH. J.: "The Electrodeposition of Platinum and Platinum Alloys"</p> <p>PLATINUM METALS REV., vol. 32, no. 4, 1988, pages 188-197, XP002448020</p> <p>page 188, left-hand column, paragraph 1 - page 190, left-hand column, paragraph 2</p> <p>page 195, right-hand column, paragraph 2 - page 196, right-hand column, paragraph 1</p> <p>-----</p>	25-36,56
A	<p>WHALEN J. J. III, WEILAND, J. D., SEARSON, P. C.: "Electrochemical Deposition of Platinum from Aqueous Ammonium Hexachloroplatinate Solution"</p> <p>J. ELECTROCHEMICAL SOCIETY, vol. 152, no. 11, 21 September 2005 (2005-09-21), pages C738-C743, XP002448021</p> <p>the whole document</p> <p>-----</p>	25-36,56
A	<p>US 4 969 468 A (BYERS CHARLES L [US] ET AL) 13 November 1990 (1990-11-13)</p> <p>the whole document</p> <p>-----</p>	1-57

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2006/038061

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

## INTERNATIONAL SEARCH REPORT

International Application No. PCT/US2006 /038061

### FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-12, 13-24, 57

a microelectrode assembly with nano-wires made from an alloy of about 88% platinum and about 12% iridium by molar fraction and a method of its fabrication  
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2. claims: 37-41, 42-44

a microelectrode assembly with nano-wires including two sections of two different electrically conductive materials  
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3. claims: 45-55

a microelectrode assembly with a substrate including a plurality of nano-porous portions  
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4. claims: 25-36, 56

a method of making a microelectrode assembly including providing an electrolyte including ammonium hexachloroplatinate and sodium hexachloroiridate  
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No  
PCT/US2006/038061

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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US 4969468	A	13-11-1990	NONE	